

computer math calc
SPARE PARTS MASTER

CASIO CM-100

OPERATION MANUAL
MANUAL DE OPERACION



Dear customer,

Thank you very much for purchasing our electronic calculator.

To fully utilize its features no special training is required, but we suggest you study this operation manual to become familiar with its many abilities. To help ensure its longevity, do not touch the inside of the calculator, avoid hard knocks and unduly strong key pressing. Extreme cold (below 32°F or 0°C), heat (above 104°F or 40°C) and humidity may also affect the functions of the calculator. Never use volatile fluid such as lacquer thinner, benzine, etc. when cleaning the unit. For servicing contact your retailer or nearby dealer.

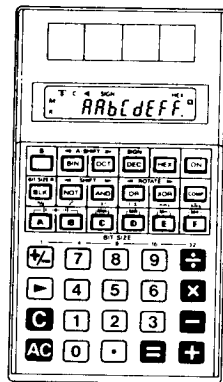
***Before starting calculation, be sure to press the $\square$ key and to confirm that "0." is shown on the display.**

***Special care should be taken not to damage the unit by bending or dropping. For example, do not carry it in your hip pocket. Since this unit is composed of precision electronic parts, do not touch the inside.**

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1/GENERAL GUIDE



1-1 The keys

In order to keep your calculator as compact as possible, each key has more than one use. You can change the function of a key by pressing certain other keys before it, or by setting the calculator in a certain mode.

The following pages will give you a more detailed explanation of the use and functions of each key.

ON ON key

Before starting calculation, be sure to press **ON** and to confirm that "0." is shown on the display. When there is insufficient light or when the light source is temporarily blocked, the display may blank out or show irregular figures. If this happens, place the unit where there is sufficient light, press **ON** and re-start your calculation. All the registers including the contents of memory will be cleared by pressing **ON**.

COMP, BIN, OCT, DEC, HEX Mode keys

COMP Selects the mode of normal calculations with decimal numbers (COMP mode). Page 16

This mode is set when the **ON** key is pressed.

BIN Selects Binary mode in Base-n mode. The BIN indicator lights. Page 25

OCT Selects Octal mode in Base-n mode. The OCT indicator lights. Page 25

DEC Selects Decimal mode in Base-n mode. The DEC indicator lights. Page 25

HEX Selects Hexadecimal in Base-n mode. The HEX indicator lights. Page 25

General keys

Data entry keys

To enter numerical values into the calculator, press these keys in their logical sequence. Page 16

Function command/Result keys

Perform the four basic calculations when these keys are pressed in formula sequence. An incorrect function command ( ,  ,  or ) is automatically cleared by pressing the correct function command key.

The  key obtains answer after entering numerals and function commands. Page 16

*When a function command key ( ,  ,  or ) is pressed, an indicator shows the corresponding command.

All clear key

Press  to clear everything except the contents of the Memory.

Clear key

Press  to erase wrong entries and to erase functional results during mixed calculations. The process of calculation remains unerased.

Right shift key

Shifts the number displayed by one digit in the direction of the arrow for entry correction. Pressing of this key is effective also in the middle of calculation and for the result of calculation.

*The result of calculation may be shifted two or more digits if it includes a fraction and has reading 0's (zeros).

Sign change key

 changes the displayed number from positive to negative or from negative to positive. You can continue entry after changing sign during entry in COMP mode but not in Base-n mode. Page 16 and 42

Memory keys

Memory recall key

Press  to display the contents of the Memory. ( does not clear the contents of the memory.) In Base-n mode, press this key following the  key. Page 20 and 34

Memory in key

Press  to put the displayed value into the Memory. The previous value in the Memory will be automatically erased. In Base-n mode, press this key following the  key. Page 20 and 34

M+ , M- Memory plus and Memory minus keys

Press **M+** to add the displayed value to the value in the Memory. Press **M-** to subtract the displayed value from the value in the Memory.

M+ (**M-**) also obtains an answer of 4 basic calculations, and automatically adds (subtracts) it to (from) the contents of the Memory. The answer obtained by this addition or subtraction will be the new value in the Memory. In Base-n mode, press these keys following the **S** key. Page 20 and 34

Special keys

[([)] Parentheses keys

This calculator calculates in this order: 1) functions, 2) multiplication and division and 3) addition and subtraction. To change this order enclose the parts that must be calculated first with **[([)]** and **[)]**. In a single expression, a maximum of 18 nesting parentheses at 6 levels can be used. In Base-n mode, press these keys following the **S** key. Page 17 and 35

hms, hms Sexagesimal notation/decimal notation conversion keys

To enter a sexagesimal value, enter the degree (hour), press **hms**, enter the minute, press **hms**, enter the second and press **hms**.

Also, press **hms** to change from decimal value to sexagesimal notation. To change from sexagesimal value to decimal notation, press **hms**. Page 53

Keys used in Base-n mode

S Shift key

Some of the keys have green lettering above them. To use a function that is green lettering, press **SHIFT**. **S** will appear on the Display. Then press the key that the green lettering identifies. **S** will disappear from the Display.

[A] ~ [F] Hexadecimal entry keys

Permits to enter hexadecimal numerals. Page 31

AND AND key

Obtains the logical product (AND) of two operands. Page 36

OR OR key

Obtains the logical sum (OR) of two operands. Page 36

XOR XOR key

Obtains the exclusive logical sum (XOR) of two operands. Page 37

[NOT] NOT key

Obtains the negation (NOT) of a operand within the specified bit range. Page 38

[S] ¹BIT SIZE ~ [S] ³²BIT SIZE Bit size specification keys Page 26

[S] ¹BIT SIZE specifies 1 bit as the range of calculations.

[S] ⁴BIT SIZE specifies 4 bits as the range of calculations.

[S] ⁸BIT SIZE specifies 8 bits as the range of calculations.

[S] ¹⁶BIT SIZE specifies 16 bits as the range of calculations.

[S] ³²BIT SIZE specifies 32 bits as the range of calculations.

[S] BIT SIZE R Bit size recall key

Displays the bit size currently specified. The previous display will be recalled about 1.5 seconds after pressing this key. Page 28

*In Binary or Octal mode, use this key when the contents of the Block 1 is displayed.

[BLK] Block key

Permits to display the upper blocks with the unit of 8 digits in Binary or Octal mode when a whole value exceeds 8 digits.

The contents of Block 1 (least significant block) will be displayed if you press this key when the most significant block is displayed. Page 28

[S] [◀]SHIFT, [S] [▶]SHIFT Logical shift keys

[S] [◀]SHIFT ([S] [▶]SHIFT) shifts the displayed value 1 bit to the left (right). Page 48

[S] [◀]ROTATE, [S] [▶]ROTATE Rotate keys

[S] [◀]ROTATE ([S] [▶]ROTATE) rotates the displayed value 1 bit to the left (right). Page 49

[S] [◀]A-SHIFT, [S] [▶]A-SHIFT Arithmetic shift keys

[S] [◀]A-SHIFT ([S] [▶]A-SHIFT) shifts the displayed data 1 bit to the left (right) arithmetically. Page 51

S **SIGN** Sign key

This key changes SIGN and UNSIGN modes alternately. The SIGN mark lights in SIGN mode and it goes out in UNSIGN mode. Page 40

UNSIGN mode is specified in Base-n mode after pressing of the **ON** key.

Function keys

✓ **Square root key**

Press **✓** to find the square root of the displayed value. Page 54

x² **Square key**

To square the displayed value, press **x²**. Page 54

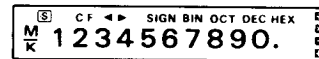
1/x **Reciprocal key**

Press **1/x** to obtain the reciprocal of the displayed value. Page 54

% **Percent key**

To find a percent of a displayed number, press the correct numbers for the percent and **%**.
Page 21

1-2 The display



+ **-** **x** **÷**
—E— or —[—

S

M

K

BIN

OCT

DEC

HEX

12° 3' 45.6"

SIGN

◀ ▶

C

F

Function command signs — see page 4.

Error indication — see page 12.

Pressing of **S** in Base-n mode — see page 26.

Something is being stored in the Memory — see page 20.

A constant is being used in calculations — see page 18.

Binary (base 2) mode — see page 25.

Octal (base 8) mode — see page 25.

Decimal (base 10) mode — see page 25.

Hexadecimal (base 16) mode — see page 25.

12° 3' 45.6" — see page 53.

SIGN mode — see page 40.

Direction of shift, rotate or arithmetic shift — see page 48.

Indicates that a carry has occurred in Base-n mode. — see page 44.

Indicates that a value is out of the calculation range in Base-n mode.
— see page 45.

2/OVERFLOW OR ERROR CHECK

Overflow or error is indicated by the "—E—" or "—[—" sign and stops further calculation.

Overflow or error occurs:

- a) When an answer, whether intermediate or final, or accumulated total in the memory exceeds 10 digits ("—E—" sign appears).
- b) When function calculations are performed with a number exceeding the input range ("—E—" sign appears).
- c) When the total number of levels of explicit and/or implicit (with addition-subtraction versus multiplication-division nested parentheses exceeds 6, or more than 18 pairs of parentheses are used ("—[—" sign appears).

Ex.) You have pressed the  key 18 times continuously before designating the sequence of    .

To release these overflow checks:

- a), b) Press the  key.
- c) Press the  key. Or press the  key, and the intermediate result just before the overflow occurs is displayed and the subsequent calculation is possible.

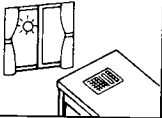
Memory protection:

The content of the memory is protected against overflow or error and the accumulated total is recalled by pressing the  key after the overflow check is released by the  key.

3/SOLAR BATTERY

- * Since this unit operates on the amorphous silicon solar battery, there is no power switch. Power will be cut off when the unit is no longer exposed to light.
- * The solar battery converts light into electrical energy. When there is insufficient light or when the light source is temporarily blocked, the display may blank out or show irregular figures. If this happens, place the unit where there is sufficient light, press the **[ON]** key and re-start your calculation.
- * **Before starting calculation, be sure to press the **[ON]** key and to confirm that "0." is shown on the display.**

This unit will operate under sunlight, fluorescent light or incandescent light. The battery's capacity for converting the light to electrical energy will vary according to the light source. The unit should be used in light of 50 lux or more.

Lighting	Note
Outdoors, near a window or in an office 	Use in lighting that will not tire the eyes when reading or doing office work for extended periods of time.
Fluorescent lighting 	Place the unit approximately 1.5m (5ft) below a 15W fluorescent lamp with sufficient brightness for reading a newspaper.
Incandescent lighting 	Place the unit approximately 2.5m (8ft) below a 100W incandescent lamp. (Effectiveness will vary with the shape or color of the lampshade.)

4/NORMAL CALCULATIONS

Press the **COMP** key to perform normal calculations.

* Calculations can be performed in the same sequence as the written formula (true algebraic logic).

* Nesting of up to 18 parentheses at 6 levels is allowed.

4-1 Four basic calculations (incl. parenthesis calculations)

EXAMPLE	OPERATION	READ-OUT
$23+4.5-53=-25.5$	$23 \text{+} 4 \text{.} 5 \text{=}$ 53=	-25.5
$56 \times (-12) \div (-2.5) = 268.8$	$56 \text{ } \times \text{ } 12 \text{ } \div \text{ } 2 \text{.} 5 \text{=}$	268.8
$3+\underline{5 \times 6} (=3+30) = 33$	$3 \text{+} 5 \text{ } \times \text{ } 6 \text{=}$	$33.$
$\underline{7 \times 8} - \underline{4 \times 5} (=56-20) = 36$	$7 \text{ } \times \text{ } 8 \text{=}$ $4 \text{ } \times \text{ } 5 \text{=}$	$36.$

$$1+2-\underline{3 \times 4 \div 5} + 6 = 6.6$$

$$1 \text{+} 2 \text{=}$$
 $3 \text{ } \times \text{ } 4 \text{ } \div \text{ } 5 \text{+} 6 \text{=}$ 6.6

$$\frac{3+4 \times 5}{5} = (3+4 \times 5) \div 5 = 4.6$$

$$(3 \text{+} 4 \text{ } \times \text{ } 5) \text{ } \div \text{ } 5 \text{=}$$
 4.6

* The number of levels of the **()** key may be displayed.

$$2 \times \{7+6 \times (5+4)\} = 122$$

$$2 \text{ } \times \text{ } ($$
 $7 \text{+} 6 \text{ } \times \text{ } ($ $5 \text{+} 4 \text{=}$ $122.$

* It is unnecessary to press the **()** key before the **=** key.

$$10 - \{7 \times (3+6)\} = -53$$

$$10 \text{=}$$
 $(7 \text{ } \times \text{ } (3 \text{+} 6 \text{=}$ $-53.$

Another operation: 10= $(7 \text{ } \times \text{ } (3 \text{+} 6 \text{=}$ $-53.$

4-2 Constant calculations

*The "K" sign appears when a number is set as a constant.

*It is possible to perform constant calculations even in Base-n mode. See page 34.

EXAMPLE	OPERATION	READ-OUT
$3+2.3=5.3$	$2 \square 3 \text{+} \text{+} \text{+} 3 \text{=}$	κ 5.3
$6+2.3=8.3$	6=	κ 8.3
$7-5.6=1.4$	$5 \square 6 \text{=} \text{=} 7 \text{=}$	κ 1.4
$-4.5-5.6=-10.1$	$4 \square 5 \text{=}$	κ -10.1
$2.3 \times 12 = 27.6$	12=	κ 27.6
$(-9) \times 12 = -108$	9=	κ -108.
$74 \div 2.5 = 29.6$	$2 \square 5 \text{=}$	κ 29.6
$85.2 \div 2.5 = 34.08$	$85 \square 2 \text{=}$	κ 34.08

$$17+17+17+17=68$$

$$1.7^2=2.89$$

$$1.7^3=4.913$$

$$1.7^4=8.3521$$

$$3 \times 6 \times 4 = 72$$

$$3 \times 6 \times (-5) = -90$$

$$\frac{56}{4 \times (2+3)} = 2.8$$

$$\frac{23}{4 \times (2+3)} = 1.15$$

$17 \text{+} \text{+} \text{+}$	κ	34.
=	κ	51.
=	κ	68.

$1 \square 7 \text{=}$	κ	2.89
=	κ	4.913
=	κ	8.3521

3=	κ	18.
4=	κ	72.
5=	κ	-90.

4=	κ	20.
56=	κ	2.8
23=	κ	1.15

4-3 Memory calculations

- *Be careful not to set the function mode to "SD" when performing memory calculations.
- *When a new number is entered into the memory by the $\boxed{M\pm}$ key, the previous number stored is automatically cleared and the new number is put in the memory.
- *To clear the contents press $\boxed{\square} \boxed{M\pm}$ or $\boxed{AC} \boxed{M\pm}$ in sequence.
- *The "M" sign appears when a number is stored in the memory.
- *It is possible to perform memory calculations even in Base-n mode. See page 34.

EXAMPLE	OPERATION	READ-OUT
53+6= 59	53 $\boxed{+}$ 6 $\boxed{=}$ $\boxed{M\pm}$	M 59.
23-8= 15	23 $\boxed{-}$ 8 $\boxed{=}$ $\boxed{M\pm}$	M 15.
56×2=112	56 $\boxed{\times}$ 2 $\boxed{=}$ $\boxed{M\pm}$	M 112.
+) 99÷4= 24.75	99 $\boxed{\div}$ 4 $\boxed{=}$ $\boxed{M\pm}$	M 24.75
210.75	$\boxed{MR}$	M 210.75

$$7+7-7+(2\times 3)+(2\times 3)+(2\times 3) \\ -(2\times 3)=19$$

$$\begin{array}{r} 12\times 3= 36 \\ -) 45\times 3=135 \\ \hline 78\times 3=234 \\ \hline 135 \end{array}$$

7 $\boxed{M\pm}$ $\boxed{M\pm}$ $\boxed{M\pm}$ 2 $\boxed{\times}$ 3 $\boxed{M\pm}$ $\boxed{M\pm}$ $\boxed{M\pm}$ $\boxed{M\pm}$ $\boxed{MR}$	M 19.
3 $\boxed{\times}$ $\boxed{\times}$ 12 $\boxed{=}$ $\boxed{M\pm}$	M 36.
45 $\boxed{M\pm}$ $\boxed{M\pm}$	M 135.
78 $\boxed{M\pm}$	M 234.
$\boxed{MR}$	M 135.

4-4 Percentage calculations

EXAMPLE	OPERATION	READ-OUT
12% of 1500 180	1500 $\boxed{\times}$ 12 $\boxed{\%}$	180.
Percentage of 660 against 880 75%	660 $\boxed{\div}$ 880 $\boxed{\%}$	75.
15% add-on of 2500 2875	2500 $\boxed{\times}$ 15 $\boxed{\%}$ $\boxed{+}$	2875.

25% discount of 3500 2625

$$3500 \times 25\% = 2625.$$

300cc is added to a solution of 500cc. What is the percent of the new volume to the initial one?

$$300 \div 500\% = 160. (\%)$$

If you made \$80 last week and \$100 this week, what is the percent increase?

$$100 - 80\% = 25. (\%)$$

12% of 1200 144

$$1200 \times 12\% = 144.$$

18% of 1200 216

$$18\% = 216.$$

23% of 1200 276

$$23\% = 276.$$

26% of 2200 572

$$26 \times 2200\% = 572.$$

26% of 3300 858

$$3300\% = 858.$$

26% of 3800 988

$$3800\% = 988.$$

Percentage of 30 against 192...15.625%
Percentage of 156 against 192...81.25%

$$192 \div 30\% = 15.625$$

$$156\% = 81.25$$

600 grams was added to 1200 grams. What percent is the total to the initial weight?..... 150%
510 grams was added to 1200 grams. What percent is the total to the initial weight? 142.5%

$$1200 + 600\% = 150.$$

$$510\% = 142.5$$

How many percent down is 138 grams to 150 grams? down 8%
How many percent down is 129 grams to 150 grams?..... down 14%

$$150 - 138\% = -8.$$

$$129\% = -14.$$

5/BINARY, OCTAL, DECIMAL AND HEXADECIMAL CALCULATIONS

■ Functions of Base-n calculations

- Conversion from binary/octal/decimal/hexadecimal modes to different modes
- Arithmetic operations (including parenthesis calculations)
- Memory calculations
- Constant calculations
- Sign change (as complement)
- Logical operations (AND, OR, XOR, NOT)
- Bit size specification (1, 4, 8, 16, 32)
- Block display
- Shifts (shift, rotate, arithmetic shift)
- Flag indications

■ Mode specification

- BIN** — Binary mode
- OCT** — Octal mode
- DEC** — Decimal mode
- HEX** — Hexadecimal mode

■ Calculation range (Display range)

Binary numbers:

Positive 0 ~ 011 1111 (32 digits)

Negative 100 0000 (32 digits) ~ 111 1111 (32 digits)

Octal numbers:

Positive 0 ~ 1777777777

Negative 2000000000 ~ 3777777777

Decimal numbers:

–2147483648 ~ 2147483647

Hexadecimal numbers:

Positive 0 ~ 7FFFFFFF

Negative 80000000 ~ FFFFFFFF

■ Characters and numbers used

Binary: 0 and 1

Octal: 0, 1, 2, 3, 4, 5, 6 and 7

Decimal: 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9

Hexadecimal: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E and F

5-1 Bit size specification and block display

■ Bit size specification

It is possible to specify the calculation range (bit size) in Base-n mode.

¹
[S] [BIT SIZE] specifies 1 bit.

⁴
[S] [BIT SIZE] specifies 4 bits.

⁸
[S] [BIT SIZE] specifies 8 bits.

¹⁶
[S] [BIT SIZE] specifies 16 bits.

³²
[S] [BIT SIZE] specifies 32 bits.

• Bit sizes and the numbers of digits.

	BINARY	OCTAL	DECIMAL	HEXADECIMAL
1 bit	1	1	1	1
4 bits	4	2	2	1
8 bits	8	3	3	2
16 bits	16	6	5	4
32 bits	32	11	10	8

*The 32-bit size is specified immediately after pressing of the [ON] key.

Note: If you change the bit size to a smaller value, the overflow bits (upper bits) are truncated in the displayed value or recalled value from the memory. The value stored in the memory remains unchanged.

■ Bit size recall

Press **[S]** **[BIT SIZE B]** to verify the bit size currently specified. The display appears as follows for about 1.5 seconds after pressing of this key.

-32- Indicates that the bit size is 32.

■ Block display

The value cannot be displayed at a time when its size is large (enclosed with bold line in the table of bit sizes and the numbers of digits).

At this time, you can read the value, block by block (up to 4 blocks), using the **[BLK]** key. Each block consists of 8 digits. Every time you press the **[BLK]** key, the displayed information changes to the contents of the block of the next higher order. The contents of Block 1 (least significant block) appear after the most significant block.

*The **[BLK]** key is ineffective if the value consists of a single block.

*Ten digits will be displayed at a time when the 32-bit size is specified in Decimal mode.

• Block display example (32 bits in Binary mode)

10111010	10111100	10110001	11011011
Block 4	Block 3	Block 2	Block 1

The value shown above will be displayed in the following manner.

[BLK]	.1.1.011011
[BLK]	.1.0110001.
[BLK]	.1011110.0.
[BLK]	101110.1.0.
[BLK]	.1.1.011011

The contents of Block 1 are displayed. (The three dots on the left side indicate the presence of three blocks of higher order.)

The contents of Block 2 are displayed.

The contents of Block 3 are displayed.

The contents of Block 4 are displayed.

The contents of Block 1 are displayed again.

Every time you press the **[BLK]** key, the dot moves from the left end to the right end.

•Block display and the dot locations

Binary mode

•32 bits

Block 1	.0.0.000000
Block 2	.0.0000000.
Block 3	.00000000.0.
Block 4	0000000.0.0.

•16 bits

Block 1	.00000000
Block 2	00000000.

Octal mode

•32 bits

Block 1	.00000000
Block 2	000.

5-2 Base conversions

*It is possible to convert values from one mode to another.

EXAMPLE	OPERATION	READ-OUT
Bit size: 8 $22_{10} = 10110_2$ $= 26_8$ $= 16_{16}$	DEC S 8 BIT SIZE 22 BIN OCT HEX	000 00010110 026 16
Bit size: 32 $7FFFFFFF_{16} = 2147483647_{10}$	AC S 32 BIT SIZE HEX 7FFFFFFF DEC HEX	7FFFFFFF 2147483647 7FFFFFFF

*The keys $\boxed{A}$ ~ $\boxed{F}$ are for hexadecimal numbers.

5-3 Four arithmetic operations

*Numbers of varying notation may mix in calculations.

*In the following examples, bit size should be specified first of all.

EXAMPLE	OPERATION	READ-OUT
Bit size: 8 $10111_2 + 11010_2 = 110001_2$	$\text{BIN } 10111 \text{ + } 11010 \text{ =}$	00110001
Bit size: 16 $123_8 \times AB_{16} = 3771_{16}$ $= 14193_{10}$	$\text{OCT } 123 \text{ x } \text{HEX } AB \text{ =}$ DEC	3771 14193
Bit size: 16 $1F2D_{16} - 100_{10} = 7881_{10}$ $= 1EC9_{16}$	$\text{HEX } 1F2D \text{ - } \text{DEC } 100 \text{ =}$ HEX	07881 $1EC9$

Bit size: 8

$$16_8 \div 2_8 = 7_8$$

$$\text{OCT } 16 \text{ : } 2 \text{ = } 007$$

Bit size: 8

$$1011_2 + 1101_2 \times 110_2 \div 11_2 - 1111_2 = 10110_2$$

$$\text{BIN } 1011 \text{ + } 1101 \text{ x } 110 \text{ : } 11 \text{ - } 1111 \text{ = } 00010110$$

Bit size: 16

$$1234_{10} + 1EF_{16} \div 24_8 = 2352_8$$

$$= 1258_{10}$$

$$\text{DEC } 1234 \text{ + } \text{HEX } 1EF \text{ : } \text{OCT } 24 \text{ = } 002352$$

$$\text{DEC } 1258$$

*For mixed calculations, multiplication and division take priority over addition and subtraction (true algebraic logic).

Bit size: 16

$$\begin{array}{r} 486_{16} + 1AF_{16} = 635_{16} \\ 6724_8 + 52_8 = 6776_8 \\ +) 10111_2 + 11101_2 = 110100_2 \\ \hline 5223_{10} \end{array}$$

[HEX] 486 [÷] 1AF [=] [S] [MR]
 [OCT] 6724 [÷] 52 [=] [S] [M+]
 [BIN] 10111 [÷] 11101 [=] [S] [M+]
 [S] [MR] [DEC]

M	0635
M	006776
M	.00110100
M	5223

*Press the Memory keys, following the [S] key.

Bit size: 8

$$\begin{array}{l} 10_2 + 1011_2 = 1101_2 \\ 110_2 + 1011_2 = 10001_2 \end{array}$$

[BIN] 1011 [÷] [÷] 10 [=]
 110 [=]

κ	00001101
κ	00010001

Bit size: 16

$$\begin{array}{l} 20_8 \times 60_8 = 1400_8 \\ 5_8 \times 60_8 = 360_8 \end{array}$$

[OCT] 60 [×] [×] 20 [=]
 5 [=]

κ	001400
κ	000360

Bit size: 16

$$50_{16} \times (1001_2 + 24_8) = 4420_8$$

[HEX] 50 [×] [S] [BIN] 1001 [÷] [OCT] 24 [S] [M+]
 [=] 004420

*Press the Parenthesis keys, following the [S] key.

*The parenthesized expressions will be calculated earlier than the other.

5-4 Logical operations

The following logical operations can be executed on the operand(s).

AND logical product of two operands

OR logical sum of two operands

XOR exclusive logical sum of two operands

NOT negation

*In the following examples, bit size should be specified first of all.

EXAMPLE	OPERATION	READ-OUT
Bit size: 8 $19_{16} \text{ AND } 1A_{16} = 18_{16}$	<code>HEX 19 AND 1A</code>	<code>18</code>
Bit size: 8 $1110_2 \text{ AND } 36_8 = 16_8$ $= 1110_2$	<code>BIN 1110 AND OCT 36</code> <code>BIN 00001110</code>	<code>016</code>
Bit size: 8 $23_8 \text{ OR } 61_8 = 63_8$	<code>OCT 23 OR 61</code>	<code>063</code>
Bit size: 8 $50_{16} \text{ OR } 1101_2 = 5D_{16}$	<code>HEX 50 OR BIN 1101</code> <code>HEX 5d</code>	<code>01011101</code> <code>5d</code>

Bit size: 4

$$5_{16} \text{ XOR } 3_{16} = 6_{16}$$

`HEX 5 XOR 3` `6`

Bit size: 8

$$12_{16} \text{ AND } F_{16} = 2_{16}$$

`HEX F AND 12` `κ 02`

$$5C_{16} \text{ AND } F_{16} = C_{16}$$

`5C` `κ 0C`

*Constants can be used in logical operations (AND, OR and XOR).

Bit size: 8

$$1010_2 \text{ AND } (A_{16} \text{ OR } 7_{16}) = A_{16}$$

$$= 1010_2$$

`BIN 1010 AND S (HEX A OR 7 S)` `0A`
`BIN 00001010`

Bit size: 16

NOT of 10110_2

BIN 10110 NOT BLK

.11101001
11111111.

 Block 1
Block 2
(= 111111111101001)

Bit size: 16

NOT of 1234_8

OCT 1234 NOT BLK 176543

Bit size: 32

NOT of $2FFFFED_{16}$

HEX 2FFFFED NOT BLK FFd00012

5-5 Mixture of arithmetic and logical operations

Arithmetic and logical operations can be mixed.

•Precedence of operations

1. NOT
2. $\times$, $\div$
3. $+$, $-$
4. AND
5. OR, XOR

EXAMPLE

Bit size: 8

$26_8 \times 32_8$ OR 46_8

OCT 26 $\times$ 32 OR 46 = BLK 076

Bit size: 16

32_{16} AND $1A_{16} \times$ NOT of $19_{16} + 46_{16} = 22_{16}$

HEX 32 AND 1A $\times$ 19 NOT $+$ 46 = BLK 0022

5-6 SIGN and UNSIGN modes

Base-n mode can be divided into SIGN and UNSIGN modes. In SIGN mode, the most significant bit (of binary notation) is the sign bit and a negative number is represented with the two's complement.

In UNSIGN mode, negative numbers cannot be represented as no bit is used for the sign.

• Calculation range

SIGN mode $-2^{n-1} \sim 2^{n-1} - 1$

Example: $-8 \sim 7$ (4 bits)

UNSIGN mode $0 \sim 2^n - 1$ (positive only)

Example: $0 \sim 15$ (4 bits)

*(n = bit size)

*Pressing of **[S]** **[SIGN]** specifies SIGN or UNSIGN mode alternately.

*UNSIGN mode is selected after pressing of the **[ON]** key.

Examples: SIGN mode UNSIGN mode
4 bits: $1010_2 = -6_{10} \quad 10_{10}$

SIGN Mode	Decimal	UNSIGN Mode
	15	1111
	14	1110
	13	1101
	12	1100
	11	1011
	10	1010
	9	1001
	8	1000
0111	7	0111
0110	6	0110
0101	5	0101
0100	4	0100
0011	3	0011

0010	2	0010
0001	1	0001
0000	0	0000
1111	-1	
1110	-2	
1101	-3	
1100	-4	
1011	-5	
1010	-6	
1001	-7	
1000	-8	

Even when the same binary number is displayed, the value may be different in SIGN and UNSIGN modes as shown above.

5-7 Sign change

The $\pm$ key permits to change the sign of the number according to mode (SIGN or UNSIGN) and bit size.

The negative number is represented as follows.

Mode	BIN	OCT	DEC	HEX
SIGN	2's complement	8's complement	Sign + absolute value	16's complement
UNSIGN	2's complement	8's complement	10's complement	16's complement

* In UNSIGN mode, no negative numbers are dealt with. With the "F" sign lit, it is represented according to the above table. (See page 44 (Flag indication))

* You cannot continue entry after sign change.

Examples of sign change (8 bits)

<UNSIGN Mode>

Operation	Read-out	
$\boxed{\text{BIN}} \ 10$	00000010	
$\pm$	^F 11111110	2's complement
$\boxed{\text{OCT}}$	376	
$\pm$	^F 002	8's complement
$\boxed{\text{DEC}}$	002	
$\pm$	^F 254	10's complement
$\boxed{\text{HEX}}$	FE	
$\pm$	^F 02	16's complement

<SIGN Mode>

Operation	Read-out	
$\boxed{\text{SIGN}} \ \boxed{\text{S}} \ \boxed{\text{DEC}}$		
$\boxed{\text{BIN}} \ 10$	^{SIGN} 00000010	
$\pm$	^{SIGN} 11111110	2's complement
$\boxed{\text{OCT}}$	^{SIGN} 376	
$\pm$	^{SIGN} 002	8's complement
$\boxed{\text{DEC}}$	^{SIGN} 2	
$\pm$	^{SIGN} -2	Sign + absolute value
$\boxed{\text{HEX}}$	^{SIGN} FE	
$\pm$	^{SIGN} 02	16's complement

5-8 Flag indications

*The flag indications are C and F. The signs light in the following conditions.

C sign

1. A carry is occurred in addition.

Example: (4 bits, SIGN mode) $\boxed{\text{BIN}} 1110 \oplus 110 \boxed{\text{C}} 0100$

*Though the result should be 10100, most significant bit is not shown in the 4-bit range and the C sign lights.

2. A borrow is occurred in subtraction.

Example: (4 bits, SIGN mode) $\boxed{\text{BIN}} 110 \ominus 111 \boxed{\text{C}} 1111$

*Though the result should be 111111, only four bits are shown because of the bit size and the C sign lights.

3. A division has resulted in a remainder.

Example: (4 bits, SIGN mode) $\boxed{\text{BIN}} 110 \div 100 \boxed{\text{C}} 0001$

*Though the remainder is 10, the C sign lights because fractional numbers cannot be indicated.
*In multiplication, the C sign never lights up.

F sign

It lights when an intermediate or final result of calculation has exceeded the calculation range. That part which has overflowed or underflowed will be truncated and not shown. The indication is as follows when the F sign is lit.

Addition and subtraction — That part which has overflowed will be truncated regardless of SIGN or UNSIGN mode.
In SIGN mode, therefore, it may occur that a positive number + a positive number = a negative number.

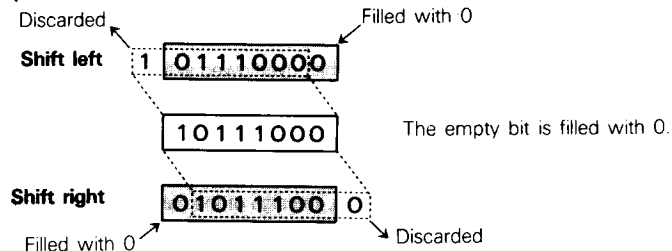
Multiplication and division — That part which has overflowed will be truncated in SIGN mode. In UNSIGN mode, the sign of the calculation result enters in the most significant bit.

5-9 Shift functions

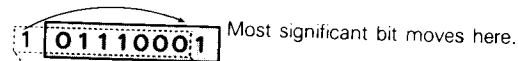
The shift functions are as follows.

1. Shift (logical shift)
2. Rotate
3. Arithmetic shift

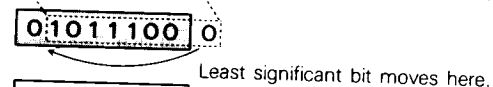
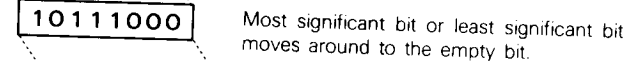
< Shift operations >



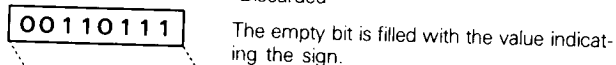
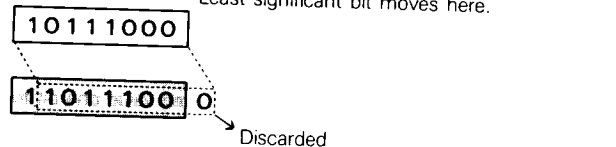
Rotate left

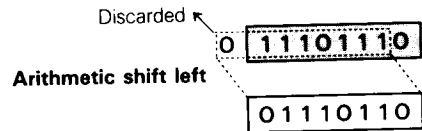


Rotate right



Arithmetic shift right





The empty bit is filled 0.

- *The C sign lights if 1 is overflowed.
- *The ◀ (or ▶) sign lights to indicate the direction of shift. The calculator memorizes how many times the value has been shifted and the ◀ (or ▶) sign goes out when you have shifted the value in the opposite direction just as many times as you shifted it.

1. Shift (logical shift)

The **[S] [SHIFT]** (**[S] [SHIFT]**) key shifts the displayed value one bit to the left (right). If you shift the result reversely just as many times you have done, the original value may not be recalled.

Examples:

8 bits: Binary

10111



00010111
00101110

(Shifts 1 bit left)

8 bits: Decimal
23



023
046

(Shifts 1 bit left)

8 bits: Binary
10111



00010111
00001011

(Shifts 1 bit right)

8 bits: Octal
27



027
013

(Shifts 1 bit right)

2. Rotate

The **[S] [ROTATE]** (**[S] [ROTATE]**) key rotates the displayed value one bit to the left (right).

Examples:

8 bits: Binary

100101



00100101

01001010

(Rotates 1 bit left)

8 bits: Decimal

37



037

074

(Rotates 1 bit left)

8 bits: Binary

101101



00101101

10010110

(Rotates 1 bit right)

8 bits: Octal

55



055

226

(Rotates 1 bit right)

3. Arithmetic shift

The **S A SHIFT** (**S A SHIFT**) key arithmetically shifts the displayed value one bit to the left (right). If you arithmetically shift the result reversely just as many times you have done, the original value may not be recalled.

Examples:

8 bits: Binary

10100



00010100

00101000

(Arithmetic-shifts 1 bit left)

8 bits: Decimal
20

S **A-SHIFT**

020

040

(Arithmetic-shifts 1 bit left)

8 bits: Binary
10011010

S **A-SHIFT**

10011010

01001101

(Arithmetic-shifts 1 bit right)

8 bits: Octal
232

S **A-SHIFT**

232

115

(Arithmetic-shifts 1 bit right)

6/FUNCTION CALCULATIONS

Scientific function keys can be utilized as subroutines or four basic calculations (including parenthesis calculations).

*Press the **COMP** key to perform function calculations.

6-1 Sexagesimal ↔ Decimal conversion

The **hms** key converts the decimal notation to the sexagesimal notation (degree (hour), minute and second).

Operation of **hms** converts the sexagesimal notation to the decimal notation.

EXAMPLE	OPERATION	READ-OUT
$14^{\circ}25'36'' = 14.42666667^{\circ}$	14 hms	14°0'0."
	25 hms	14°25'0."
	36 hms	14°25'36."
	hms	14.42666667

$$5:35'20'' + 2:53'43'' = 8:29'3''$$

5	hms	35	hms	20	hms	+	5	hms	35	hms	20	.
2	hms	53	hms	43	hms	=	8	hms	29	hms	3	.

*When a sexagesimal notation is used in a calculation, intermediate and final result is displayed in sexagesimal notation.

6-2 Square roots, Squares & Reciprocals

EXAMPLE	OPERATION	READ-OUT
$\sqrt{2} + \sqrt{3} \times \sqrt{5} = 5.287196908$	$2 \sqrt{\square} + 3 \sqrt{\square} \times 5 \sqrt{\square} =$	5.287196908
$123 + 30^2 = 1023$	$123 + 30 \square^2 =$	1023.
$\frac{1}{\frac{1}{3} - \frac{1}{4}} = 12$	$3 \square^{1/x} = 4 \square^{1/x} \square^{1/x} =$	12.

7/SPECIFICATIONS

BASIC OPERATIONS:

4 basic calculations, constants for $+/-/\times/\div$, parenthesis calculations and memory calculations.

BINARY/OCTAL/DECIMAL/HEXADECIMAL CALCULATIONS:

Base conversions, 4 arithmetic operations, constants for $+/-/\times/\div$ /AND/OR/XOR, sign change, logical operations, bit size specification, block display, shift functions (shift, rotate and arithmetic shift) and flag indications.

BUILT-IN FUNCTIONS:

Decimal $\leftrightarrow$ sexagesimal conversions, square roots, squares, reciprocals and percentage calculations.

CAPACITY:

Basic/function calculations: 10 digits

Base calculations:

Binary numbers:

Positive 0 ~ 011 1111 (32 digits)

Negative 100 0000 (32 digits) ~ 111 1111 (32 digits)

Octal numbers:

Positive 0 ~ 1777777777

Negative 20000000000 ~ 37777777777

Decimal numbers:

-2147483648 ~ 2147483647

Hexadecimal numbers:

Positive 0 ~ 7FFFFFFF

Negative 8000000 ~ FFFFFFFF

DECIMAL POINT:

Full floating with underflow.

READ-OUT:

Liquid crystal display, suppressing unnecessary 0's (zeros).

POWER SOURCE:

Amorphous silicon solar battery.

OPERATING BRIGHTNESS:

Over 50 Lux.

AMBIENT TEMPERATURE RANGE:

0°C — 40°C (32°F — 104°)

DIMENSIONS:

16mmH × 76mmW × 135mmD (5/8"H × 3"W × 5 3/8"D)

WEIGHT:

73g (2.6 oz)